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Seventh Semester B.E. Degree Examination, Dec.09/Jan.10 Computer Techniques in Power Systems

Time: 3 hrs.

Max. Marks:100

Note: Answer any FIVE full questions.

- 1 a. Define the following with neat sketches.
 i) Oriented Graph ii) Tree iii) Link iv) Singular Matrix. (08 Marks)
- b. The bus incidence matrix of a 7 element, 5-bus system is as shown in table below obtain the element – node incidence matrix. Hence draw the corresponding oriented graph of the system. (06 Marks)

$A =$	(a)	1	0	0	-1	0	0	1
	(b)	-1	-1	-1	0	0	0	0
	(c)	0	0	1	0	-1	1	0
	(d)	0	0	0	0	0	-1	-1

- c. Derive expression for Y_{BUS} using singular transformation. (06 Marks)
- 2 a. Determine the BUS admittance matrix by singular transformation analysis for the power system defined by the line data shown below in table. (08 Marks)
- | | | | | | |
|---------------------|-------|-------|-------|-------|-------|
| Line No. | 1 | 2 | 3 | 4 | 5 |
| BUS code p – q | 0 – 1 | 1 – 2 | 2 – 3 | 3 – 0 | 2 – 0 |
| Admittance in P. U. | 1.4 | 0.6 | 2.4 | 2.0 | 1.8 |
- b. Derive the algorithm for formation of bus impedance matrix $[Z_{BUS}]$ for single phase system, when a link element is added to the partial network. (12 Marks)
- 3 a. Develop a mathematical model of speed governing system of steam turbine used in load frequency control problem. Show also the corresponding block diagram. (10 Marks)
- b. Two generators rated 300 MW and 600 MW are operating in parallel. Their governors have droop characteristics of 4% and 5% respectively from no load to full load. Assuming that the generators are operating at 50Hz at no load, determine how would a load of 900MW be shared between them. What will be the system frequency at this load? Assume free governor operation. (07 Marks)
- c. Repeat the problem of part (b) and comment on the result if both the governors have a droop of 4%. (03 Marks)
- 4 a. What is load flow analysis? What are the data required to conduct load flow analysis? Explain how the buses are classified to carryout the load flow analysis in power systems. Also explain briefly the significance of slack bus. (10 Marks)
- b. Explain the load flow solution procedure of Gauss Siedal iterative method for a power system having both P–V and P–Q buses. Also explain how acceleration factors are applied at the end of each iteration. (10 Marks)

- 5 a. Explain the Newton – Raphson method of conducting load flow analysis on a power system having PQ buses ONLY in polar form. (10 Marks)
- b. Fig. Q5(b) show below is a 5-bus power system. Each line has an admittance of $(2 - j6)$ P. U. The line charging admittance are neglected. The bus power and voltage specifications are given in table. Determine the voltage at the buses 2, 3, 4 and 5 at the end of first iteration using Gauss – Seidal iteration method using Y_{BUS} .

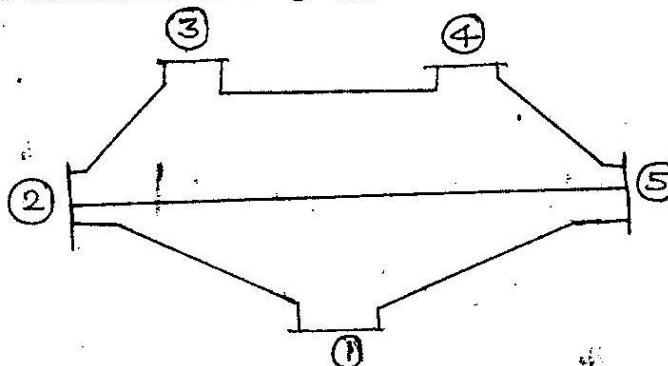


Fig. Q5(b)

BUS	P_L	Q_L	P_G	Q_G	Voltage	Type of BUS
1	1.0	0.5	–	–	$1.02 \angle 0^\circ$	Slack bus
2	0	0	2	–	1.02	P- V bus
3	0.5	0.2	0	0	–	P – Q bus
4	0.5	0.2	0	0	–	P – Q bus
5	0.5	0.2	0	0	–	P – Q bus

(10 Marks)

- 6 a. Write down the total transmission line loss formula in terms of B co-efficients and two source loadings P_1 and P_2 . Obtain the general loss co-efficient formula with usual notations. State also the assumptions made in deriving the formula. (12 Marks)
- b. A power system consists of two 100 MW units whose input cost data are given by the equations :
- $$C_1 = 0.05 P_1^2 + 20P_1 + 800 \text{ Rs. /hr.}$$
- $$C_2 = 0.06 P_2^2 + 20P_2 + 1000 \text{ Rs. /hr.}$$
- If the total received load is 150 MW, what could be the division of load between the two units for the most economic operation? Find also the annual saving in fuel cost in rupees as compared with the same load of 150 MW divided equally between the two units. (08 Marks)
- 7 a. With the help of a flow chart explain the modified Euler method for transient stability studies. (10 Marks)
- b. With the help of block diagrams explain the representation of excitor control system and the speed governor system in stability studies. (10 Marks)
- 8 Write short notes on :
- Two area load frequency control
 - Automatic economic load dispatch
 - Representation of fixed tap setting transformers for load flow analysis of power systems. (20 Marks)
